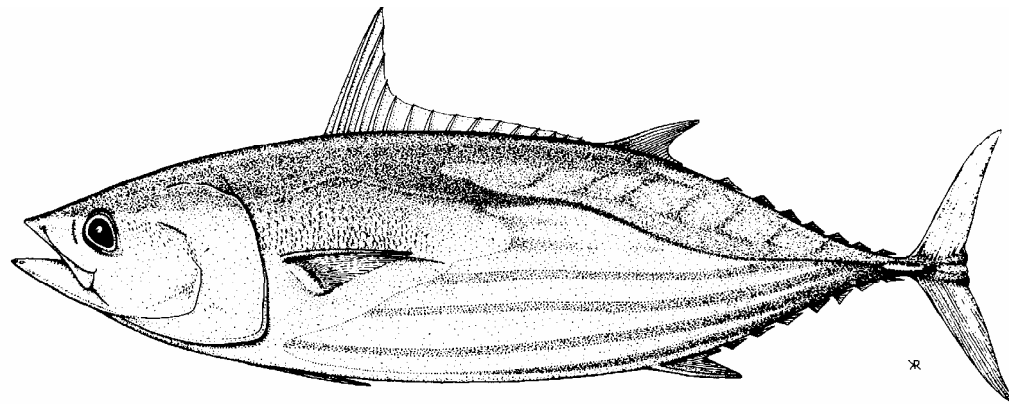


Stock assessment of skipjack tuna in the western and central Pacific Ocean (SA WP-4).

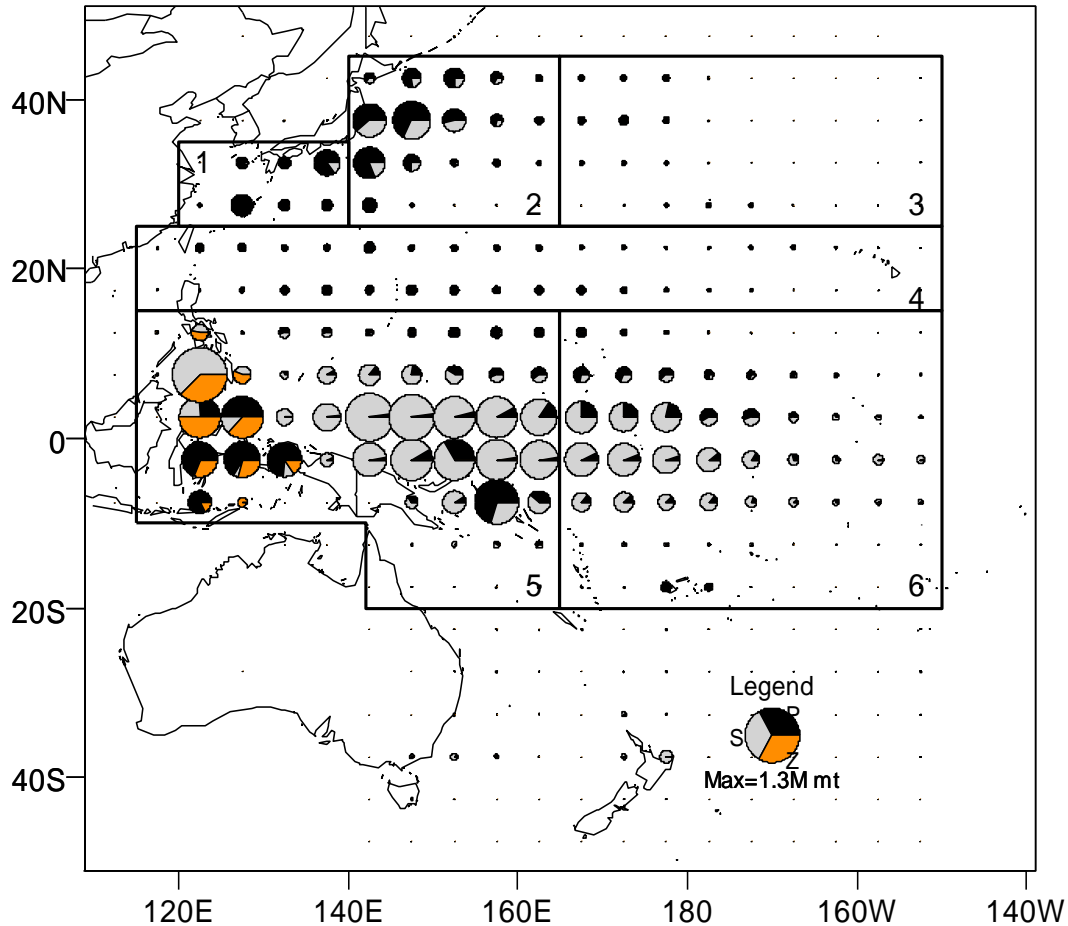


A. Langley, J. Hampton and M. Ogura

Introduction

- Previous assessment conducted in 2003.
- Model period 1972-2004.
- Update with the inclusion of further two years data (catch, effort, LF). Additional tag data from northern area.
- GLM indices for equatorial PS fishery.
- Sensitivity analyses – incremental increase in PS fishing power.
- Current biomass and F relative to reference points, yield estimates.

MFCL regions, fisheries



Northern fisheries – JP
offshore PL and PS.

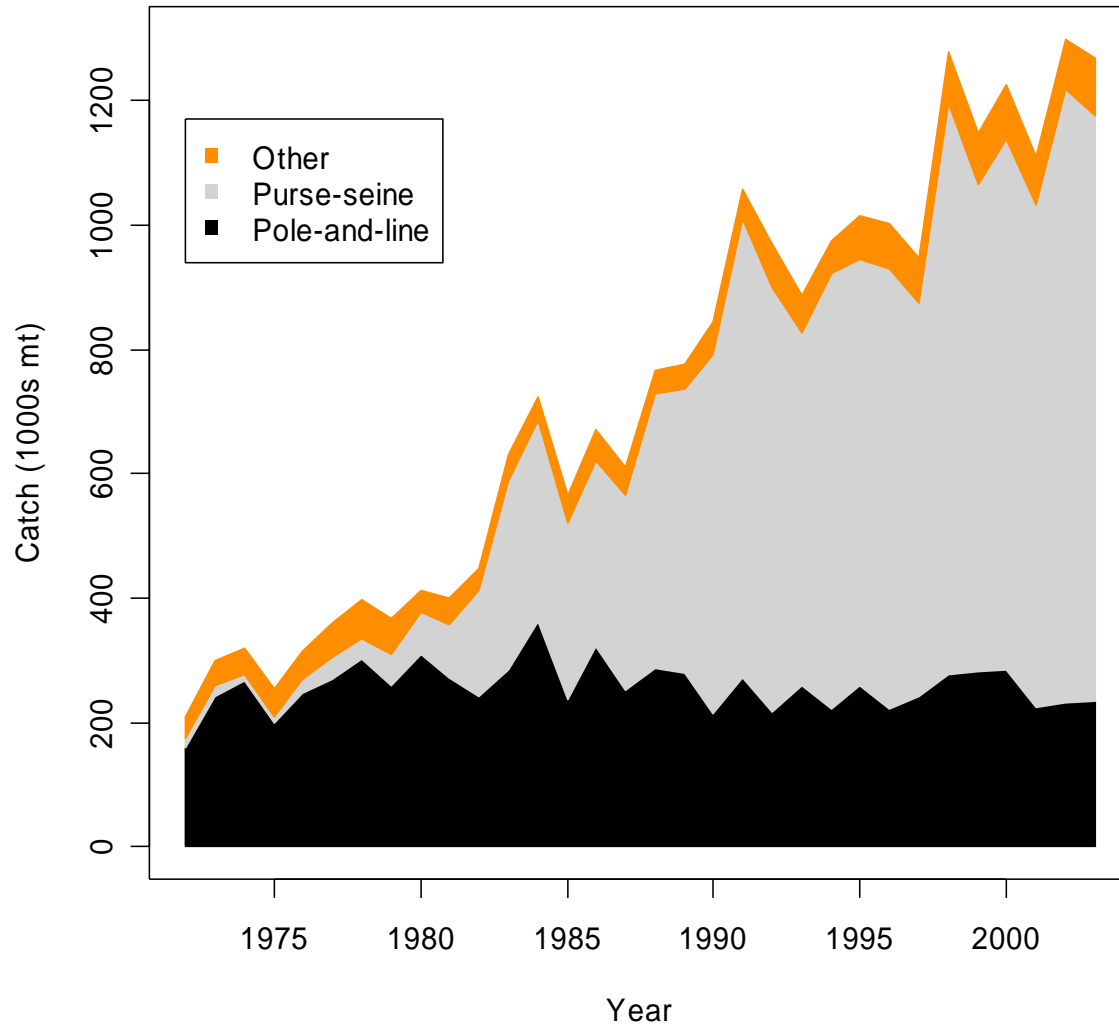
JP DW LL fisheries.

Equatorial PS fisheries.

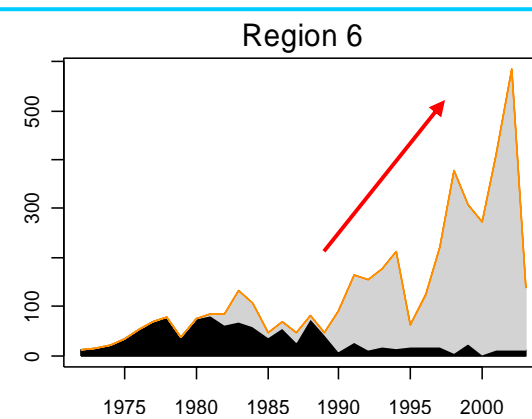
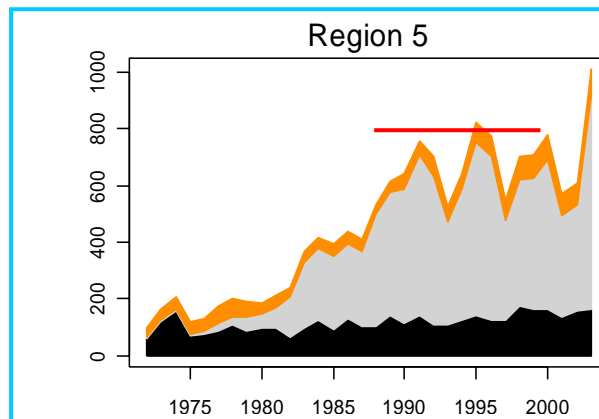
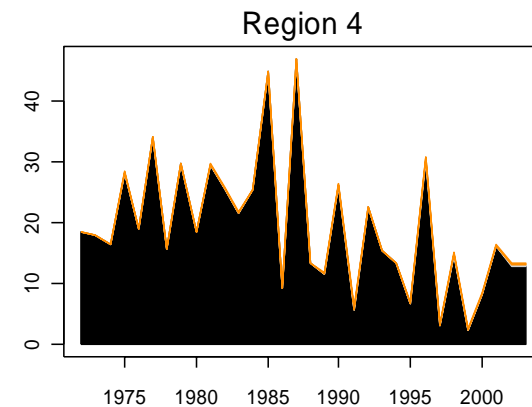
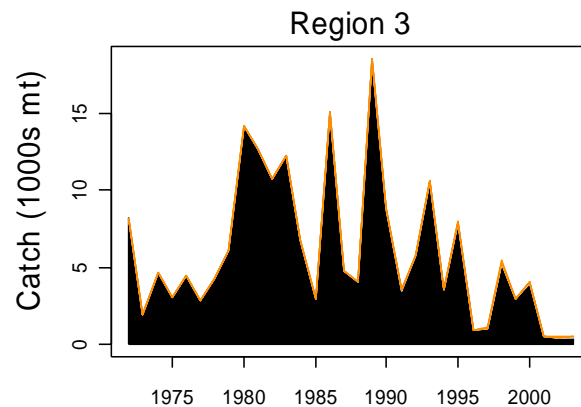
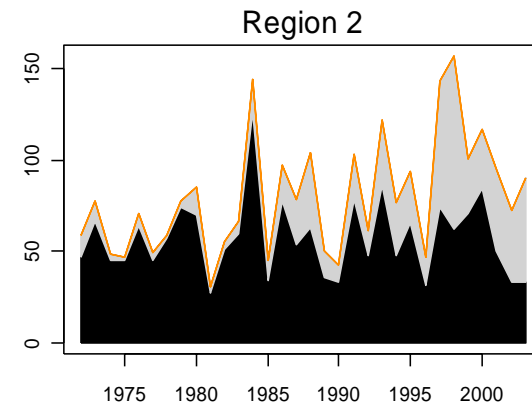
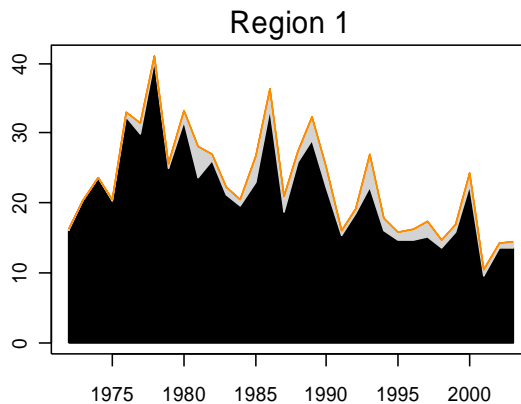
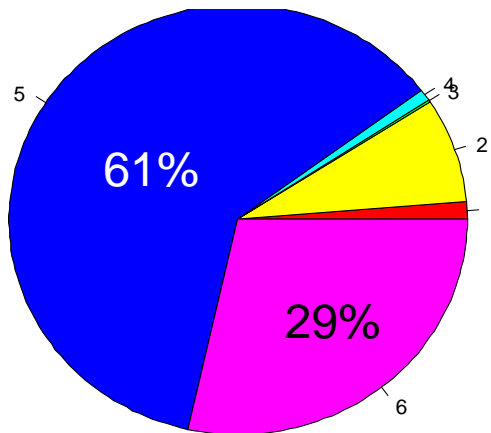
Domestic PL fisheries.

ID and PH domestic
fisheries.

Total catch



Catch by region

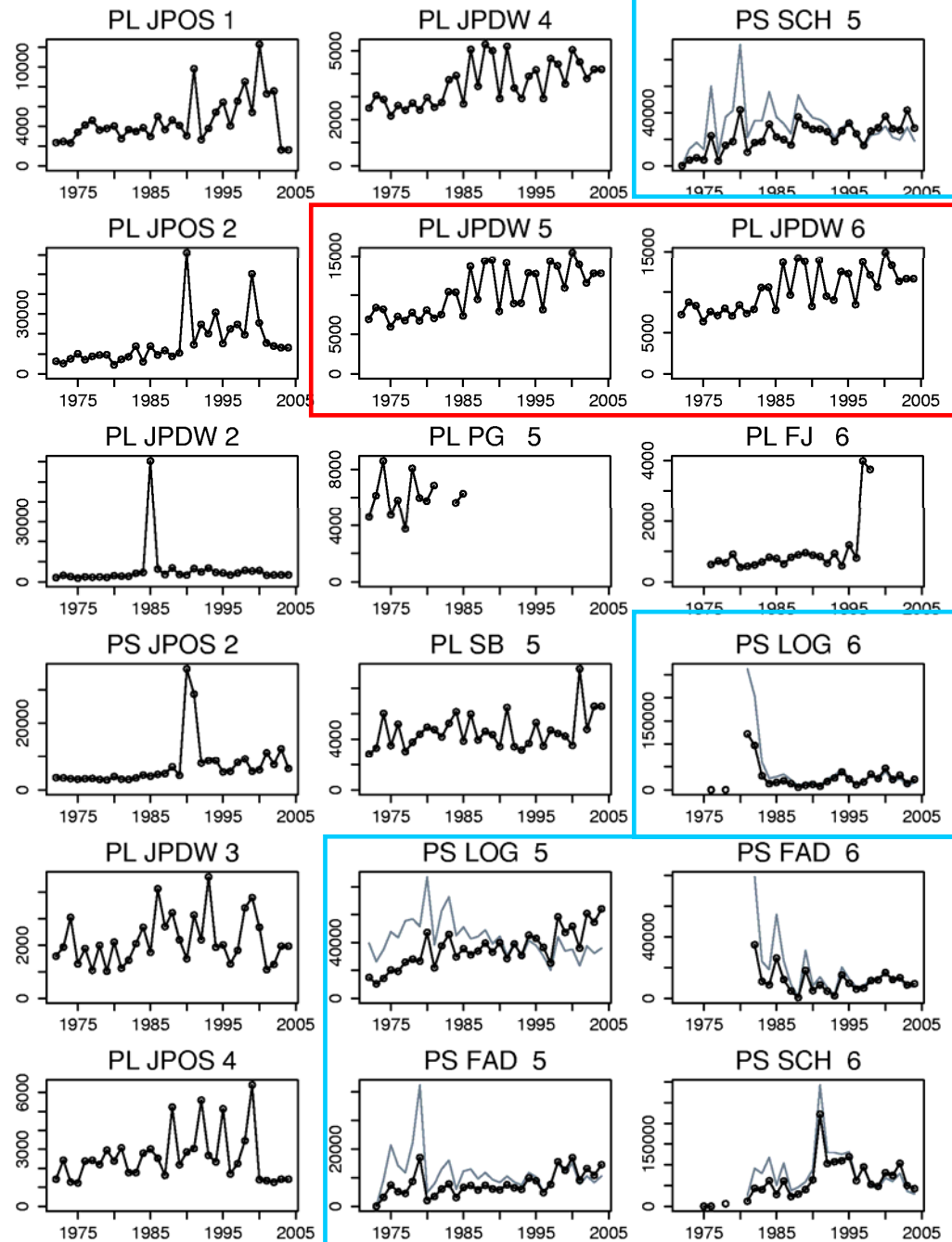


CPUE

Standardised indices for all JP Offshore PL, PS fisheries, JP DW PL.

Equatorial PS GLM indices (NEW).

Sensitivity: PS equatorial fisheries (5% increase pa) – grey line.

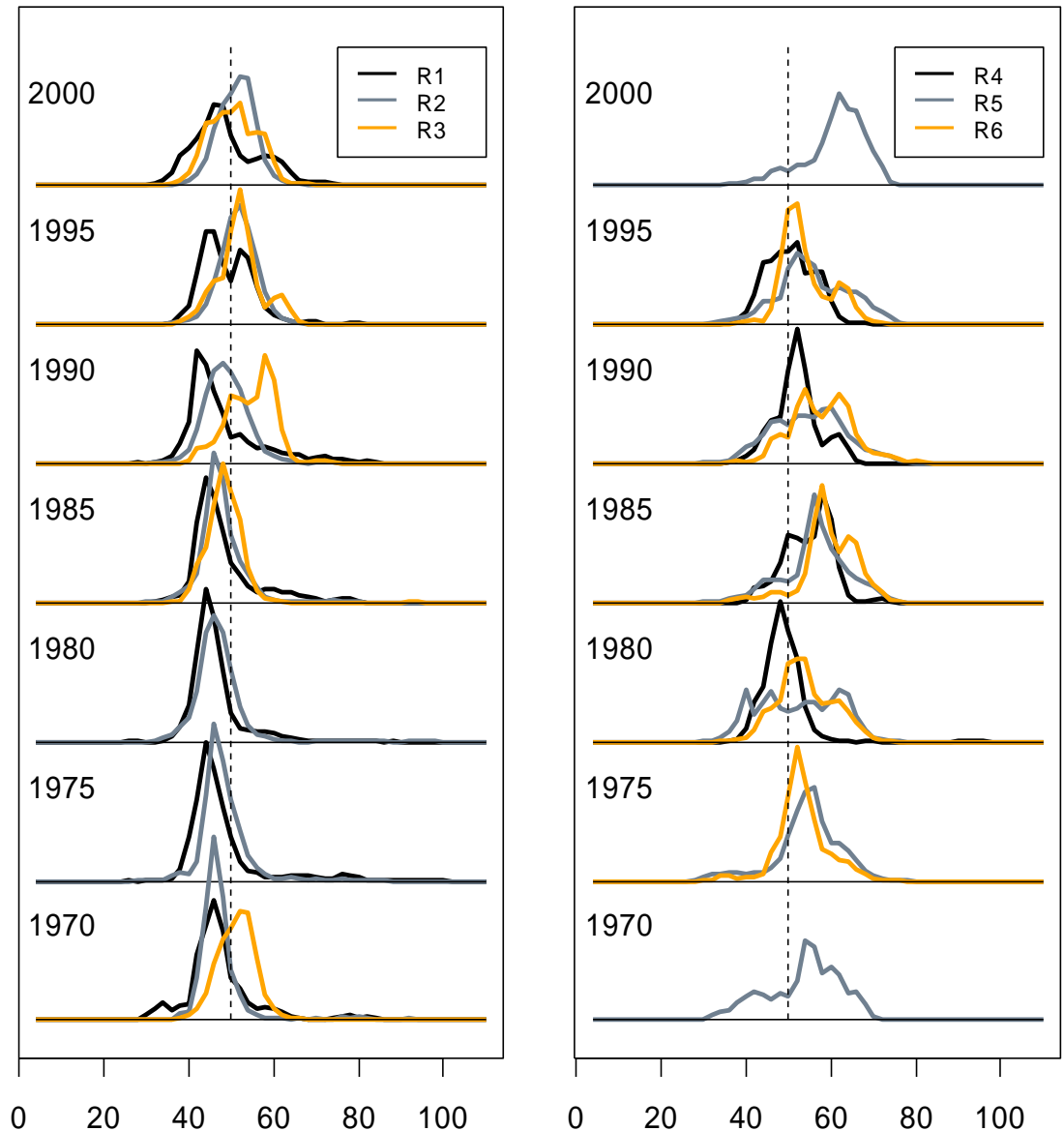


Japanese Pole-and-line data, all regions

Length data

Good coverage for most fisheries.

Converse temporal trends in fish size between PL (increasing) and equatorial PS (declining).

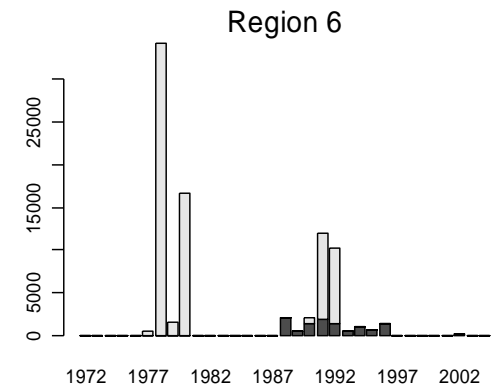
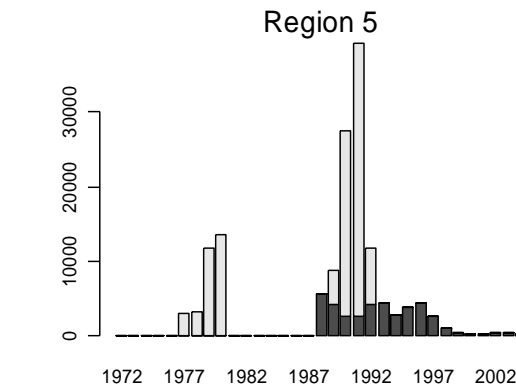
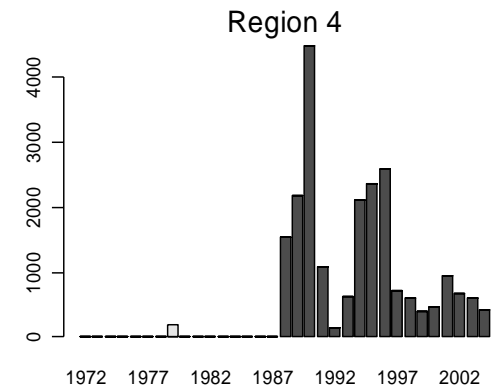
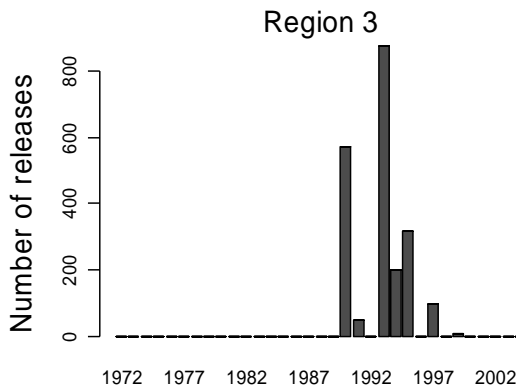
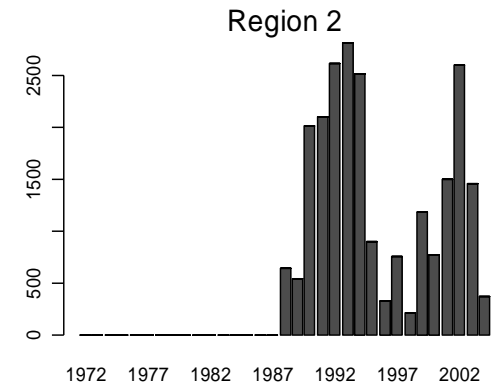
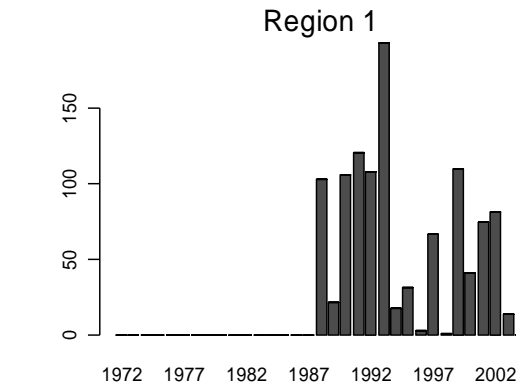


Tag data

Large tag data set.

Japanese and “OFP” releases.

Japanese releases in equatorial regions not included due to concern about different reporting rate.



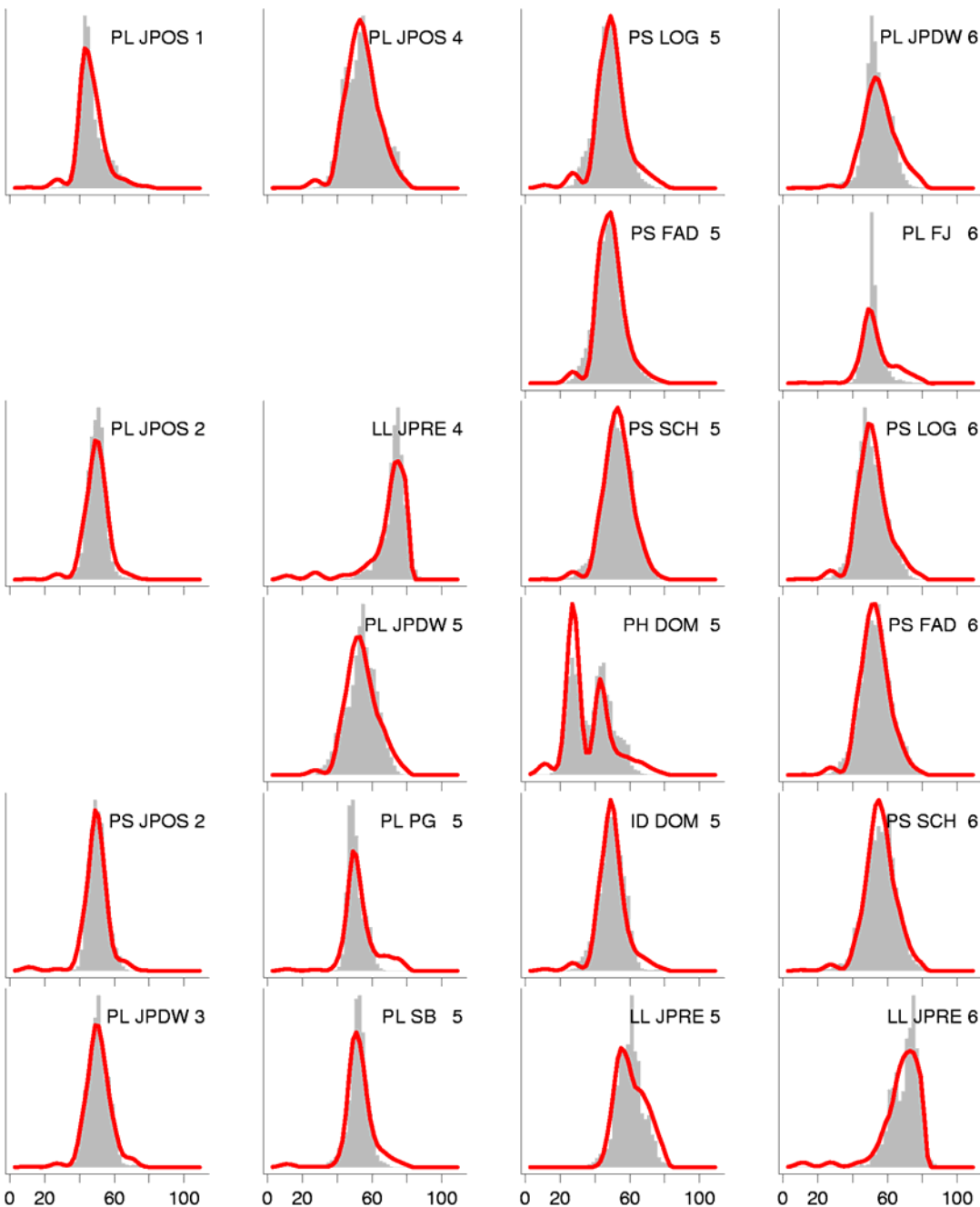
Model structure – key assumptions

- PL catchability constant over time (all).
- Constant tag RR for all JP fisheries.
- Constant tag RR for all Equatorial PS fisheries.
- Selectivity equivalent for all PL fisheries.
- M-at-age estimated.
- Regional recruitment distribution fixed.
- Age specific quarterly movement.
- Broad prior on steepness of SRR.

Model diagnostics

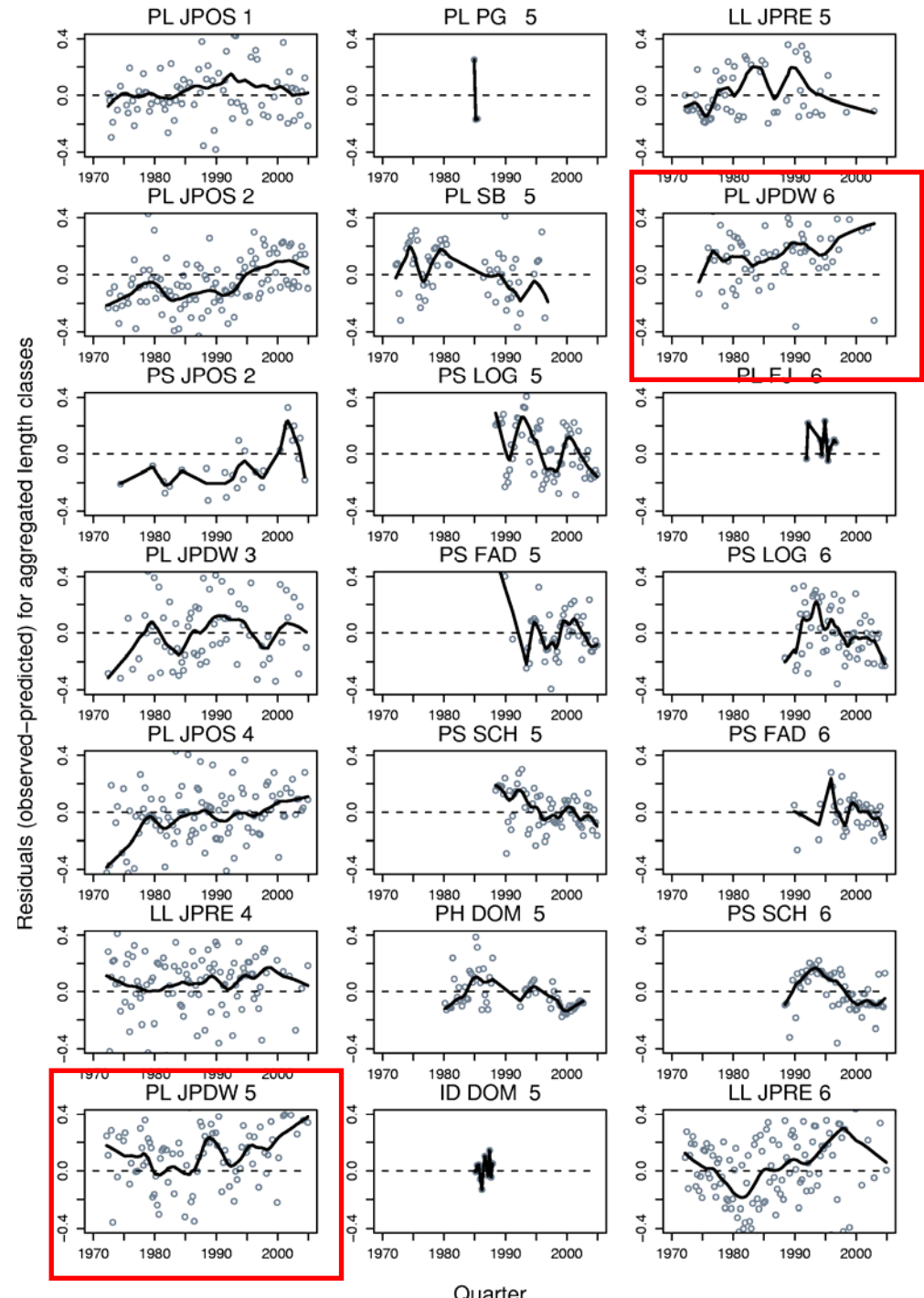
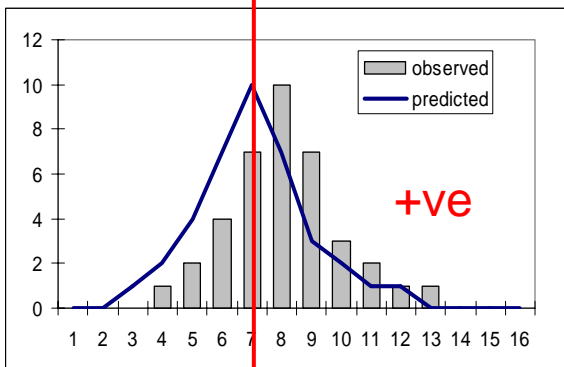
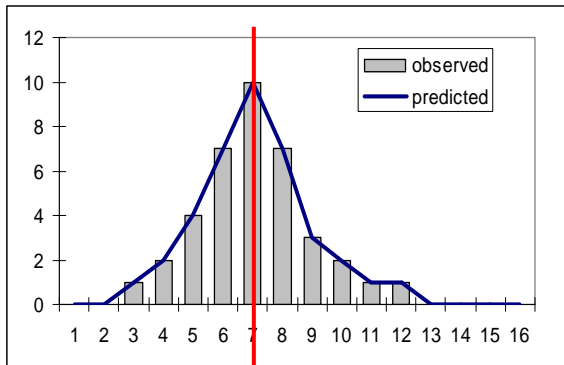
- Very good fit to the catch data.
- No strong trends in the effort deviations.
- LF data – good fit to aggregated data, some temporal trends in residuals.
- Tagging data – very good fit to aggregated data, some discrepancies by fishery.
- Estimated tagging report rates comparable to assumed/measured level for most fisheries.
- Estimated growth rate very similar to GR derived from otolith increments (Tanabe et al. 2003).
- Natural mortality at age comparable to estimates derived from tag data (Hampton 2000).

Diagnostics – LF data

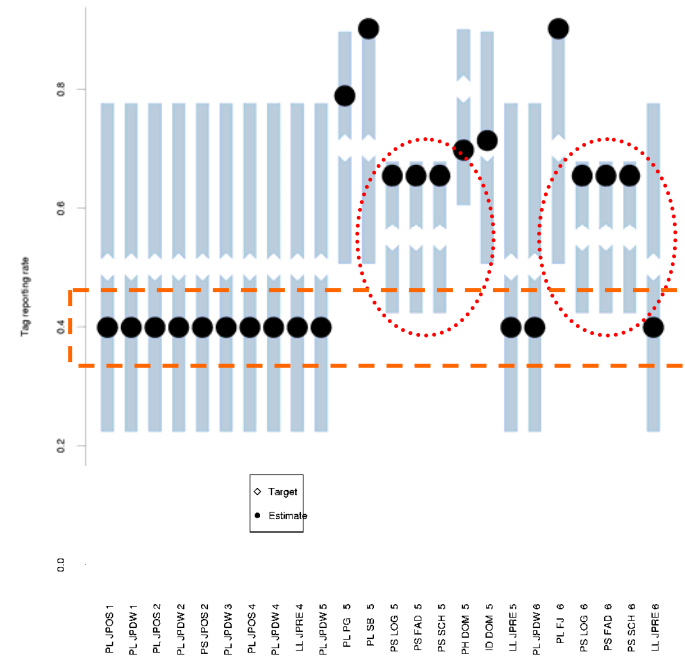
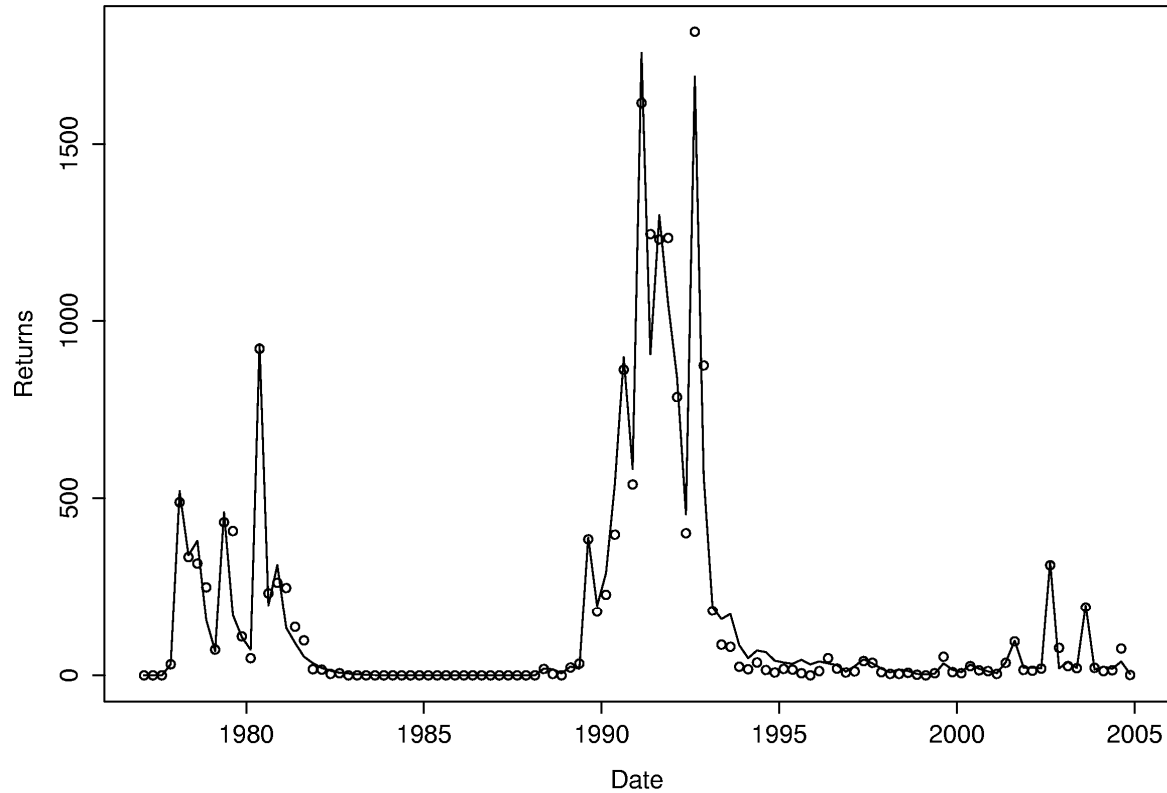


Diagnostics – LF data

Increasingly under-estimating the proportion of larger fish in the JP DW PL catch.



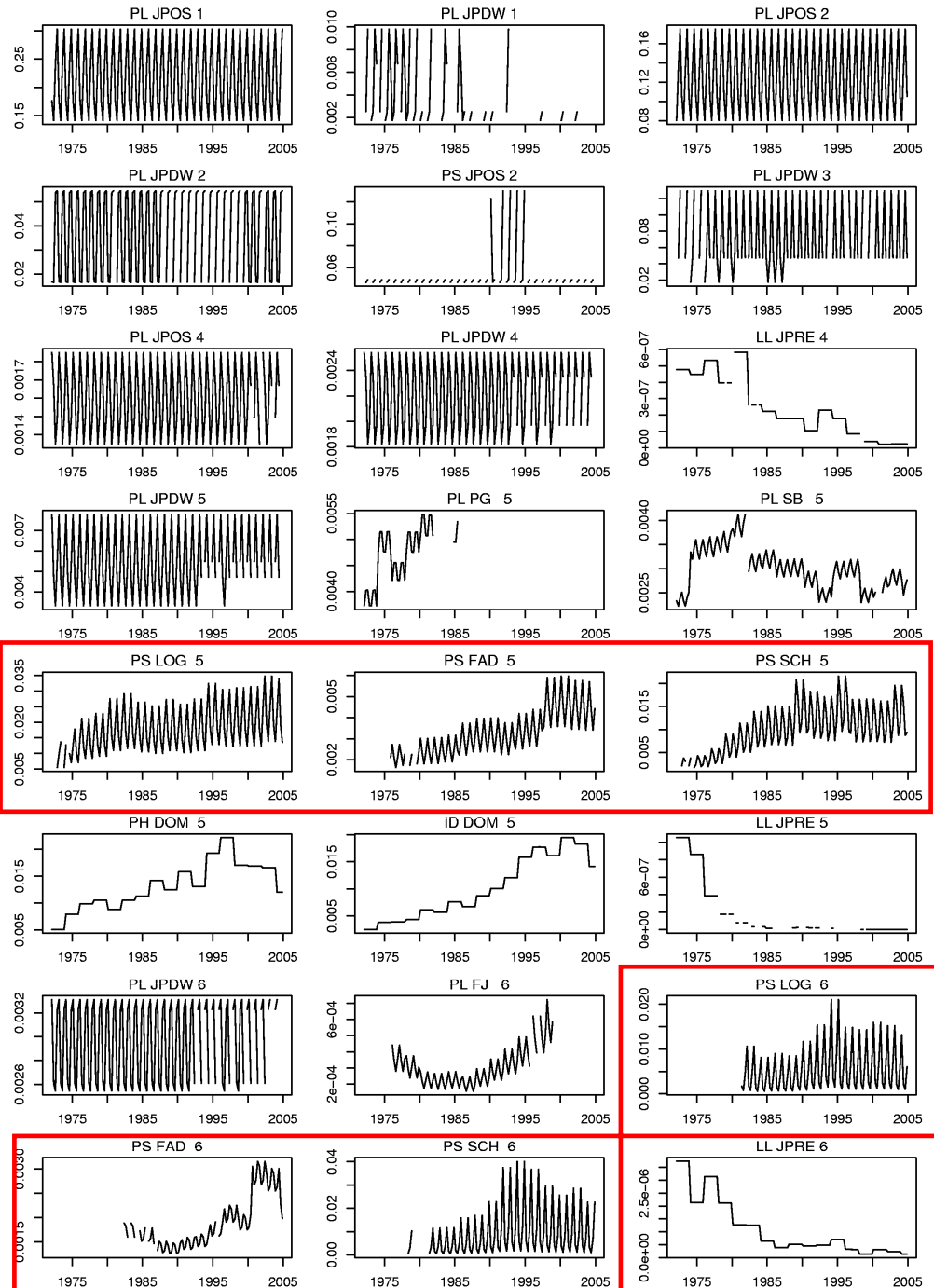
Diagnostics – tagging data



Catchability

Constant for JP PL fisheries.

Increasing for equatorial PS fisheries.

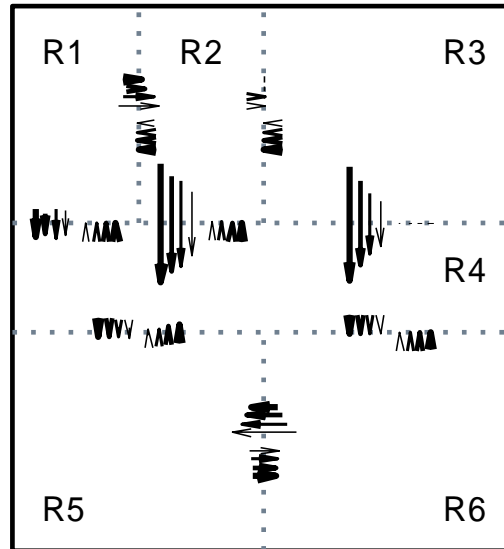


Movement

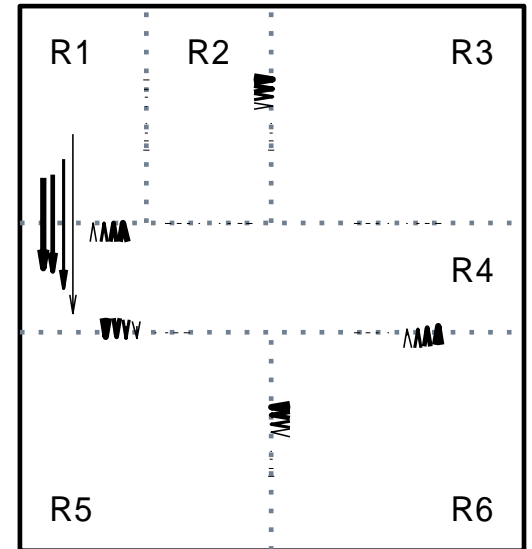
Quarterly
movement
coefficients
scaled to recent
age composition.

Main movement
occurring south
into region 4.

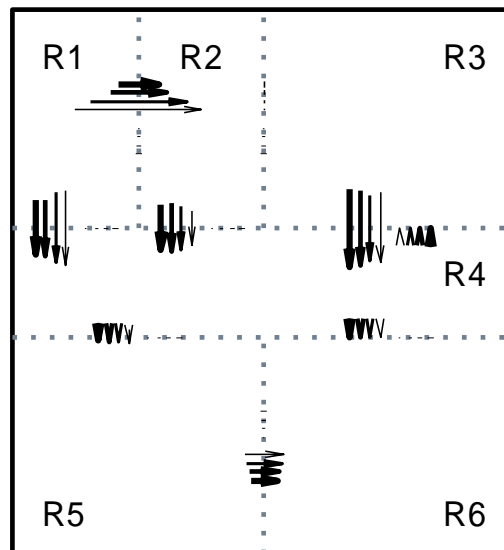
Quarter 1



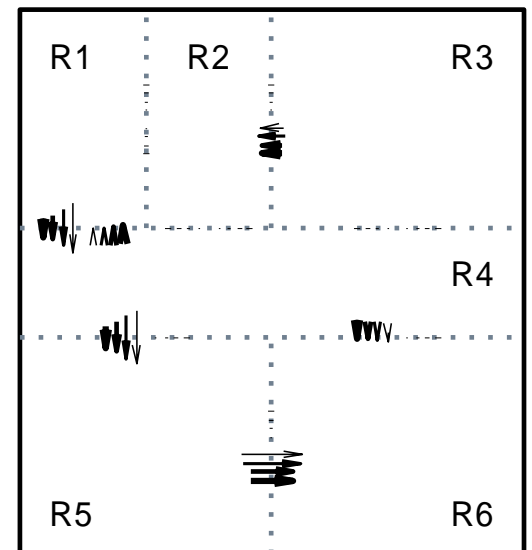
Quarter 2



Quarter 3



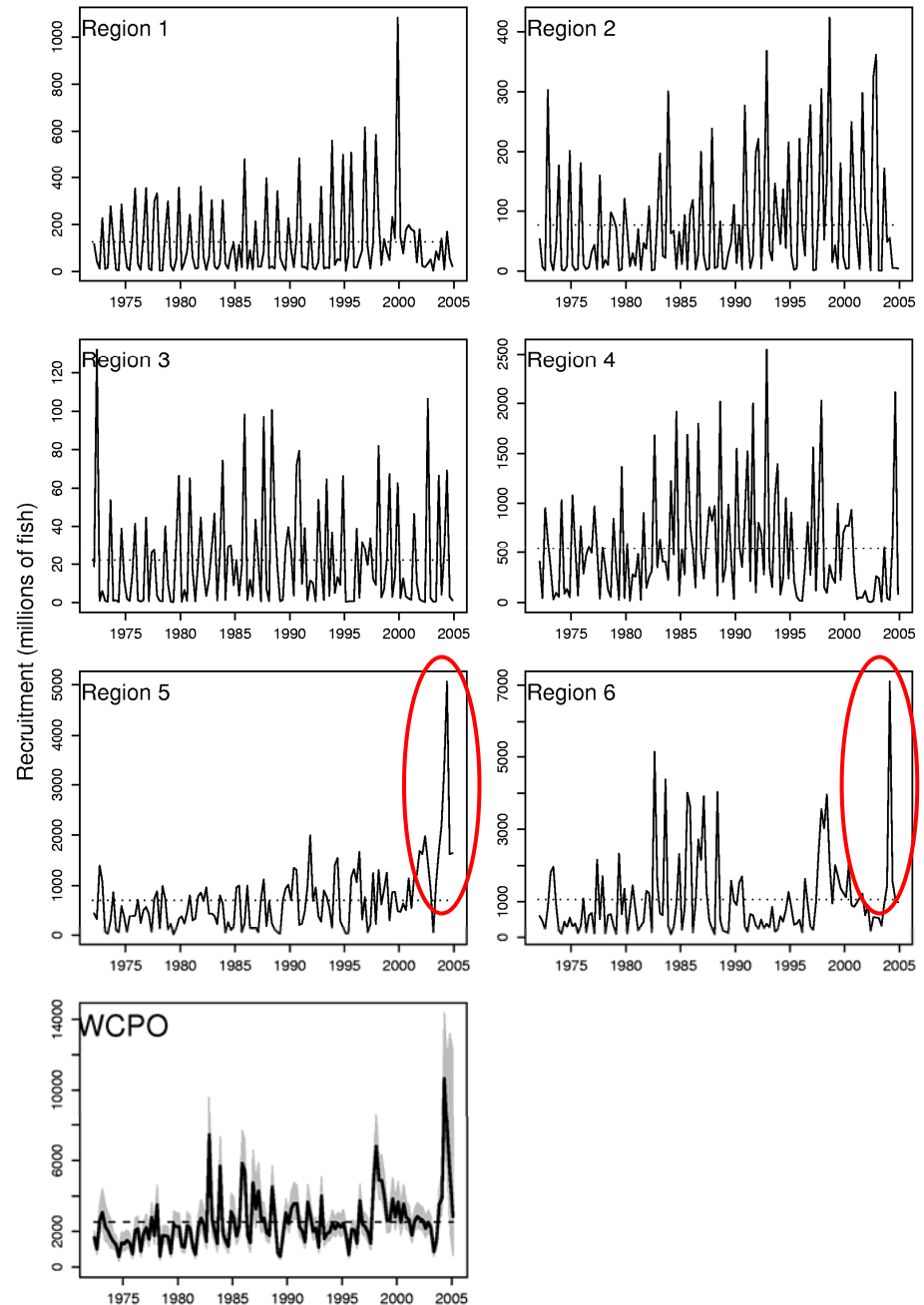
Quarter 4



Recruitment

Most of recruitment within regions 5 and 6 and also 4.

Extremely high recent recruitment in 5 and 6.

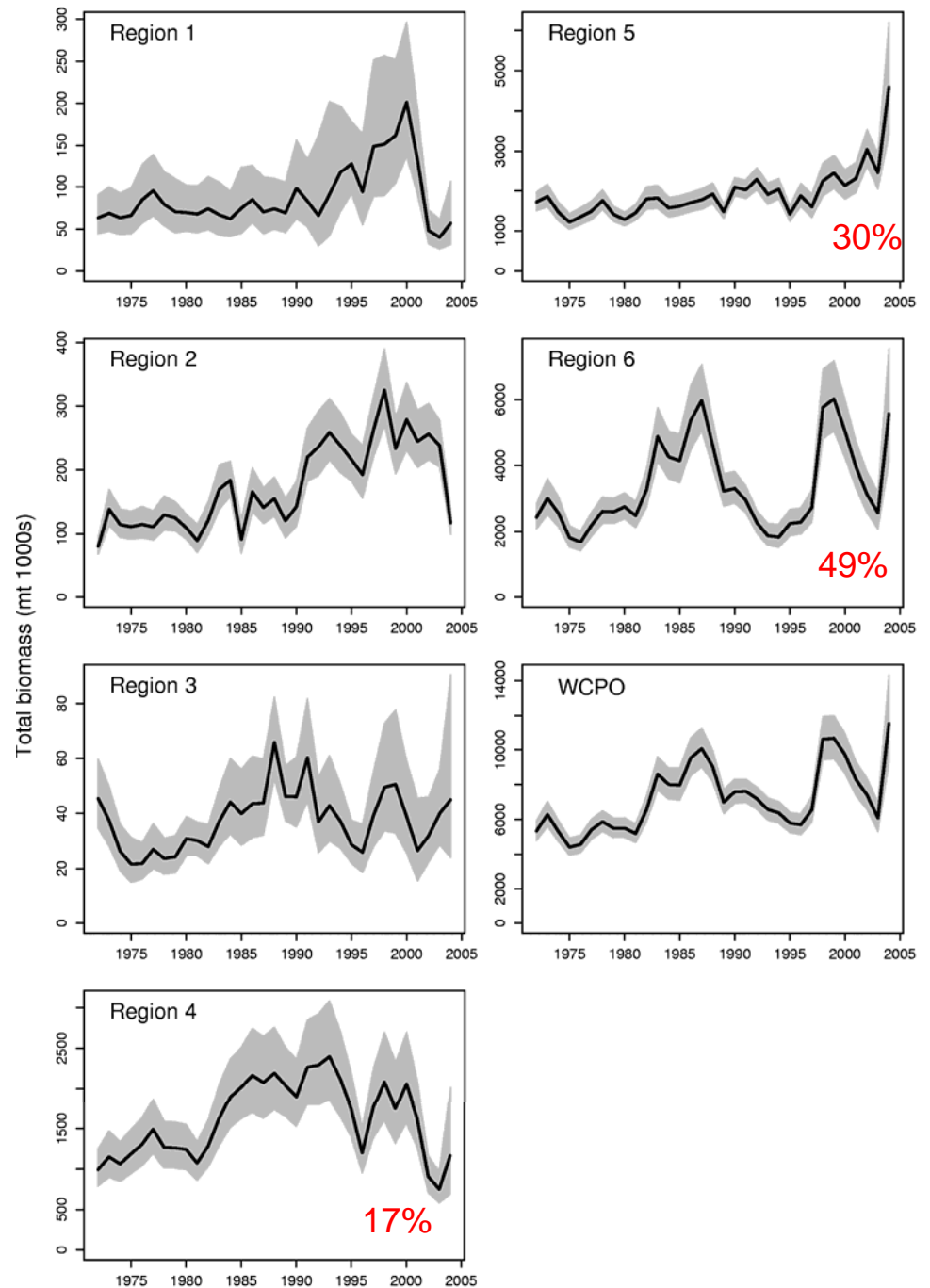
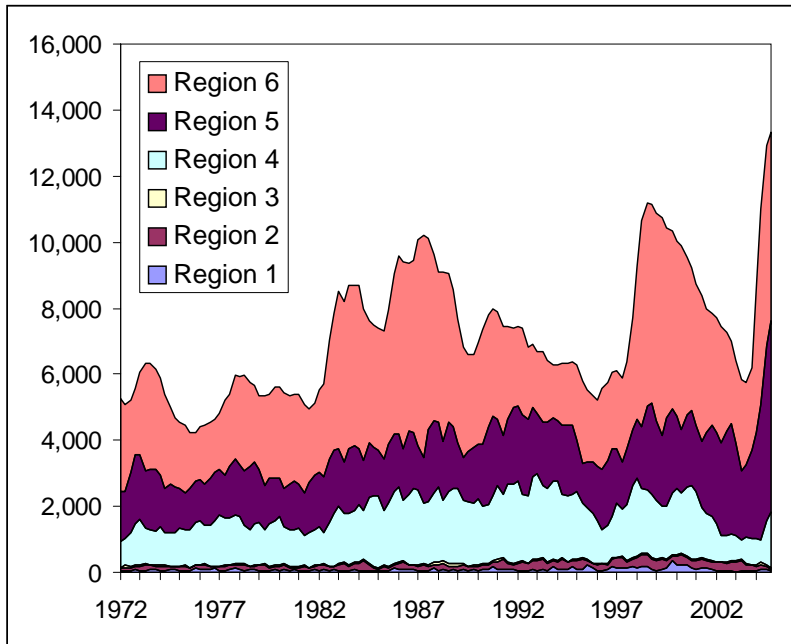


Biomass

Most of biomass in regions 4 (?), 5, and 6.

High variation in region 6.

Recent sharp increase in region 5.



Outstanding issues

- Extremely high biomass in Region 4 relative to level of catch. Biomass level largely driven by tagging data – large releases and very few recoveries in late 1980s.
- Higher level of biomass in region 6 compared to region 5.
- Recent high recruitment.

Comparison

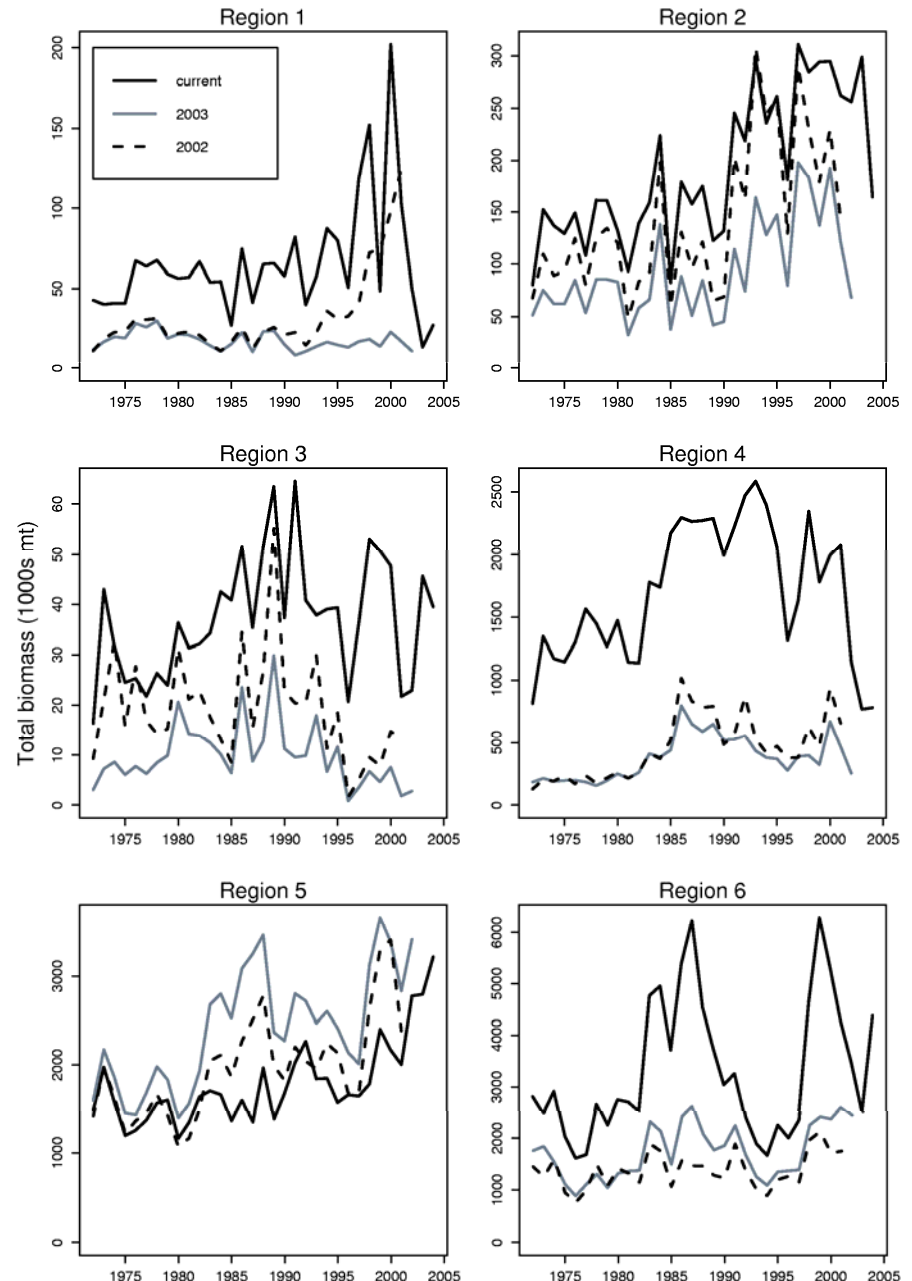
Much higher biomass in Region 4 and Region 6.

Lowered biomass level in Region 5.

Most likely driven by differences in tag reporting rate.

And the inclusion of additional years of data when high catches taken from Region 6.

Differences in northern regions relate to assumed constant q in current assessment.

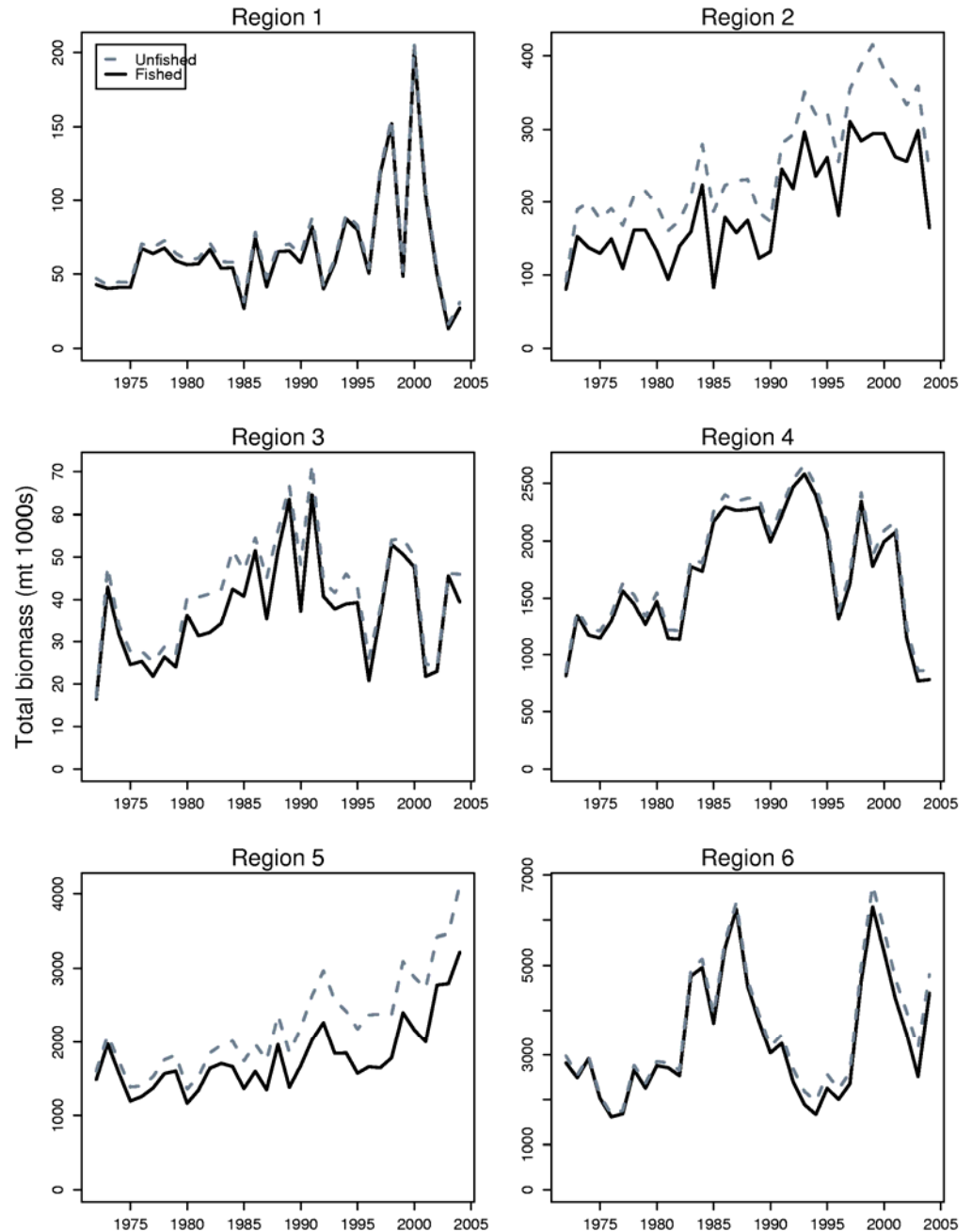


Fishery impacts

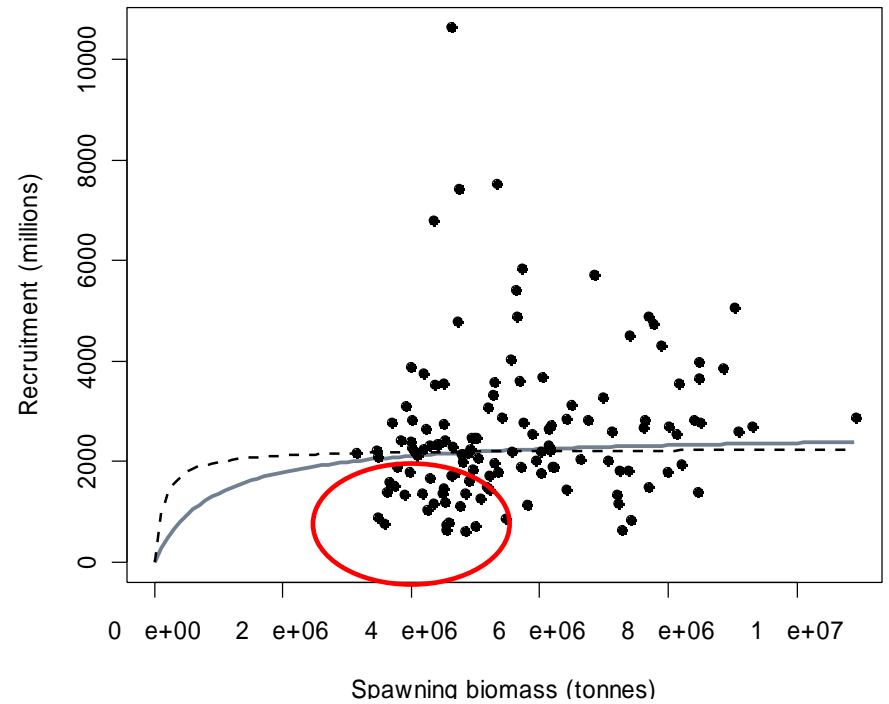
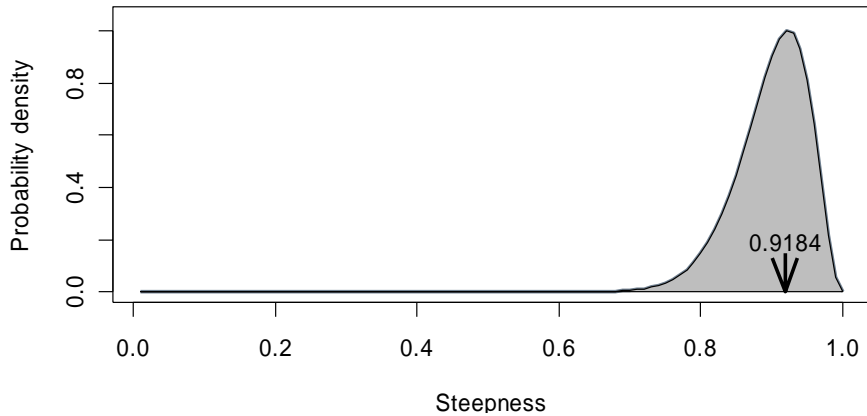
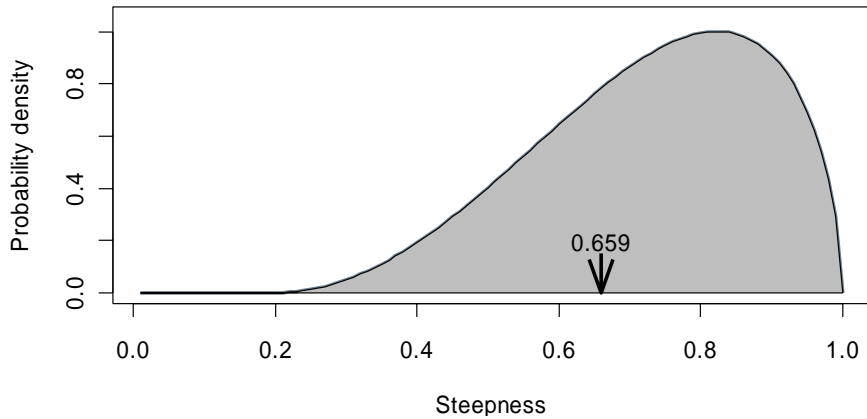
Fished and unfished total biomass.

Region 5 impact about 25%. WCPO 15%.

Similar levels of impact on the PS exploitable biomass.

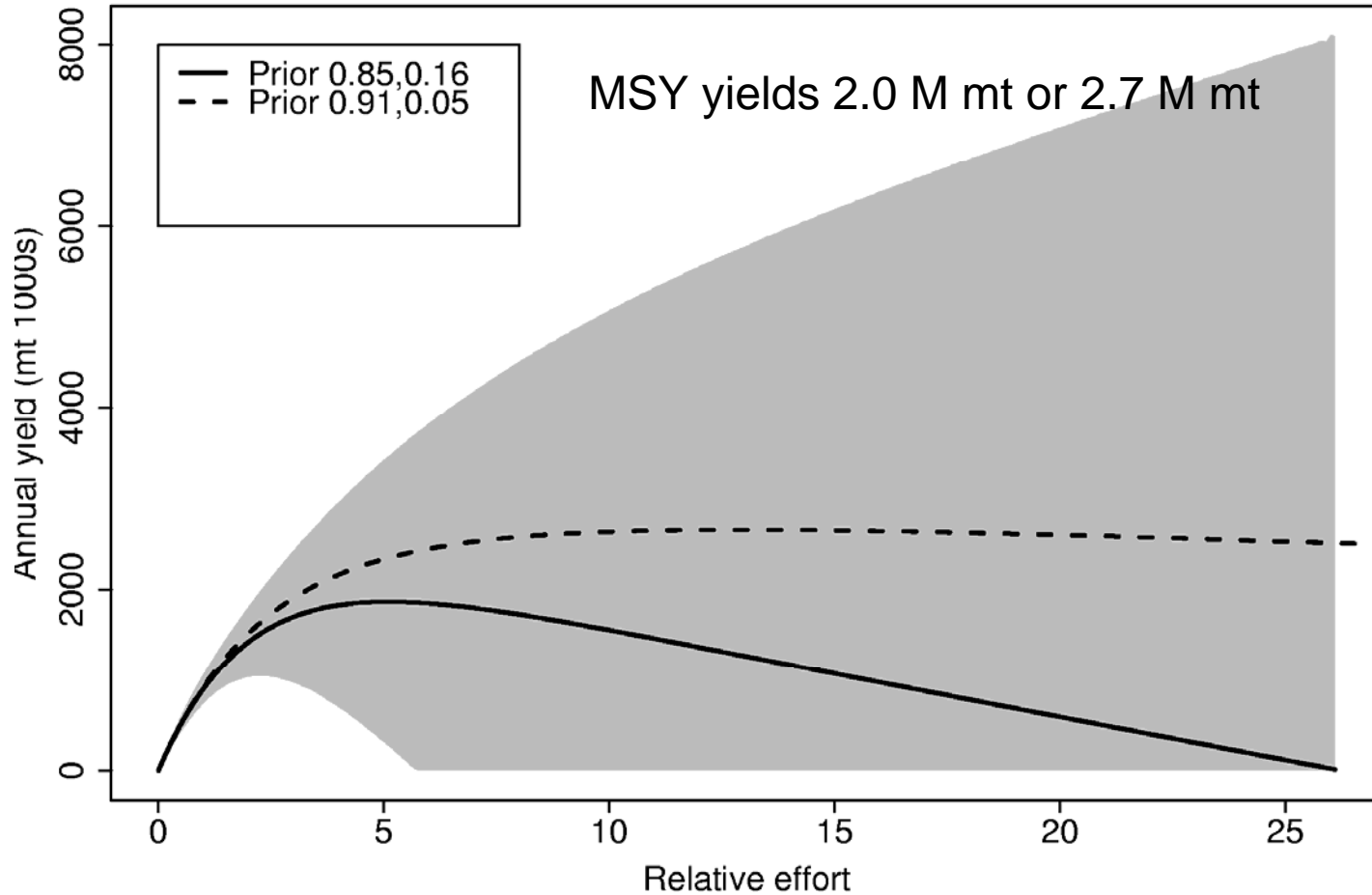


Reference points and yields



Two alternative priors on steepness for SRR.

Reference points and yields



Management quantity	Units	Base-case	High steepness	PS_fpower	PL56-fixq
$\tilde{Y}_{F_{current}}$	t per quarter	227,000	231,000	229,000	207,000
$\tilde{Y}_{F_{MSY}}$ (or <i>MSY</i>)	t per quarter	499,000	664,000	482,000	326,000
\tilde{B}_0	t	7,401,000	7,261,000	7,436,000	8,958,000
$\tilde{B}_{F_{current}}$	t	5,989,000	6,060,000	5,589,000	6,628,000
\tilde{B}_{MSY}	t	2,907,000	2,576,000	2,636,000	3,694,000
$\tilde{S\tilde{B}}_0$	t	6,025,000	5,912,000	6,130,000	7,486,000
$\tilde{S\tilde{B}}_{F_{current}}$	t	4,669,000	4,723,000	4,337,000	5,317,000
$\tilde{S\tilde{B}}_{MSY}$	t	1,865,000	1,381,000	1,618,000	2,726,000
$B_{current}$	t	8,744,000	8,720,000	7,772,000	10,764,000
$SB_{current}$	t	6,929,000	6,910,000	6,186,000	8,742,000
$B_{current, F=0}$	t	10,113,000	10,088,000	9,481,000	12,601,000
$B_{current}/\tilde{B}_0$		1.18	1.20	1.05	1.20
$B_{current}/\tilde{B}_{F_{current}}$		1.46	1.44	1.39	1.62
$B_{current}/\tilde{B}_{MSY}$		3.01	3.38	2.95	2.91
$B_{current}/B_{current, F=0}$		0.86	0.86	0.82	0.85
$SB_{current}/\tilde{S\tilde{B}}_0$		1.15	1.17	1.01	3.21
$SB_{current}/\tilde{S\tilde{B}}_{F_{current}}$		1.48	1.46	1.43	1.64
$SB_{current}/\tilde{S\tilde{B}}_{MSY}$		3.72	5.00	3.82	3.21
$\tilde{B}_{F_{current}}/\tilde{B}_0$		0.81	0.83	0.75	0.74
$\tilde{S\tilde{B}}_{F_{current}}/\tilde{S\tilde{B}}_0$		0.77	0.80	0.71	1.95
$\tilde{B}_{MSY}/\tilde{B}_0$		0.39	0.35	0.35	0.41
$\tilde{S\tilde{B}}_{MSY}/\tilde{S\tilde{B}}_0$		0.31	0.23	0.37	0.51
$F_{current}/\tilde{F}_{MSY}$		0.17	0.08	0.20	0.34
$\tilde{B}_{F_{current}}/\tilde{B}_{MSY}$		2.06	2.35	2.12	1.79
$\tilde{S\tilde{B}}_{F_{current}}/\tilde{S\tilde{B}}_{MSY}$		2.50	3.42	2.68	1.95
$\tilde{Y}_{F_{current}}/MSY$		0.46	0.35	0.47	0.63

Conclusions

- Overfishing not occurring ($F_{current} / F_{MSY} = 0.1-0.3$) *and* not in an overfished state ($B_{current} / B_{MSY} = 3.0$).
- Scenario of increased PS fishing power (5% pa) does not change conclusions regarding stock status.
- Increased yields available from the fishery, but MSY level highly uncertain. Current assessment may be “buffered” by uncertain estimates of biomass in some regions (4 and, to a lesser extent, 6).
- Improvement in current assessment would require large-scale tagging programme, principally in equatorial region.